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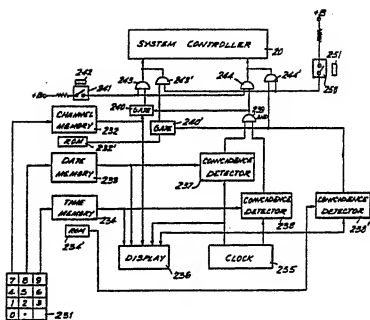
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54 Video signal recording and reproducing system with automatic channel and time selection.

57 A video recorder for automatically recording information being broadcast on at least one predetermined channel at a predetermined time comprises a tuner which tunes to any one of a plurality of channels received thereby and includes a channel selector actuable for selecting the predetermined channel, a recorder operable to record information broadcast on the channel to which the tuner is tuned, a timer actuable to cause operation of the recorder at the predetermined time, and a single, manually operable actuating member which simultaneously actuates the channel selector and the timer so that the recorder records the information broadcast on the predetermined channel at the predetermined time.

FIG. 4



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TITLE: VIDEO SIGNAL RECORDING AND REPRODUCING SYSTEM
WITH AUTOMATIC CHANNEL AND TIME SELECTION

This invention relates to information signal recording and reproducing apparatuses, and more particularly, to a video signal recording and reproducing apparatus with automatic channel and time selection capabilities.

In a scrambled or subscriber television receiving system as described in U.S. patent application Serial No. 06/415,836, filed September 8, 1982, scrambled television program signals are transmitted on a predetermined VHF channel at a predetermined time, preferably, late at night, and are recorded on a video tape recorder. Key signals to be used for descrambling the scrambled television signals are transmitted at the end of the program of scrambled television signals. A user, thus, cannot view the television program in real time, since the key signals for descrambling the scrambled television program signals are not transmitted until after the program ends.

For example, the scrambled television signals may be transmitted from 2:30 A.M. until 5:30 A.M. on channel 7, and for recording the scrambled television program on a conventional video tape recorder (VTR), the user must preset that time interval and channel number on the video tape recorder.

The system identified above suffers from 25 significant drawbacks in that the setting of the timer

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and channel selector are troublesome and inconvenient, particularly as such operations are usually undertaken at bedtime. Further, it is difficult to ascertain whether the timer has in fact been set to cause recording of the 5 scrambled television signal, since the timer is also used for selecting the usual, unscrambled television program signals which are to be recorded.

It is therefore an object of the present invention 10 to provide a video signal recording apparatus which avoids the above-described drawbacks of the prior art system.

It is another object of the present invention to provide a video signal recording apparatus which is simply actuable to automatically select both the time and channel 15 of a predetermined television program which is to be recorded.

It is yet another object of the present invention to provide a video signal recording apparatus which clearly indicates when it is set to record a predetermined 20 television program.

It is still another object of the present invention to provide a video signal recording apparatus which can be conveniently set to subsequently record a scrambled television program.

25 It is still a further object of the present invention to provide a video signal recording apparatus which can be conveniently preset to automatically record two scrambled television signal programs transmitted at predetermined respective times and/or on different channels.

In accordance with an aspect of the present invention, a video recorder for automatically recording information being broadcast on at least one predetermined channel at a predetermined time comprises tuning means for
5 tuning to any one of a plurality of channels received thereby and including channel selecting means actuable for selecting said one predetermined channel, recorder means for recording information broadcast on the channel to which the tuning means is tuned, timing means actuable for causing
10 operation of the recorder means at said predetermined time, and single, manually operable actuating member for simultaneously actuating the channel selecting means and the timing means so that the recorder means automatically records the information broadcast on the predetermined
15 channel at the predetermined time.

The above, and other objects, features and advantages of the present invention, will be apparent from the following detailed description of illustrative embodiments thereof which is to be read in connection with
20 the accompanying drawings.

Fig. 1 is a block diagram of a prior art television receiver system for recording and reproducing a scrambled television signal;

25 Fig. 2 schematically illustrates a prior art television channel selector for use with the system of Fig. 1;

Fig. 3 is a block diagram of a prior art timer included in the television signal receiving system of Fig. 1;

Fig. 4 is a block diagram similar to that of Fig. 3, but showing an embodiment of the present invention;

Fig. 5 schematically illustrates a television channel selector that may be associated with the timer of Fig. 4 in accordance with the present invention;

Fig. 6 is a block diagram of a portion of another embodiment of a timer in accordance with the present invention;

Fig. 7 is a block diagram of still another embodiment of a timer in accordance with the present invention;

Fig. 8 is a block diagram of a memory unit included in a timer according to yet another embodiment of the present invention;

Fig. 9 is a block diagram of memory units in a further embodiment of the present invention; and

Fig. 10 is a block diagram of memory units in still a further embodiment of the present invention.

Referring to the drawings in detail, and initially to Fig. 1 thereof, it will be seen that a prior art television signal recording and reproducing system is disclosed which is suitable for reproducing a scrambled television signal. The scrambled television signal system is sometimes referred to as a pay television system or a subscriber television system because only paying subscribers

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to the service are provided with a descrambler for descrambling the scrambled television signal.

In the system shown on Fig. 1, a VHF television signal is received by a VHF antenna 1 and supplied to a VHF input terminal 2 in a video cassette recorder 100. The VHF television signal supplied to VHF input terminal 2 can include both conventional television signals and scrambled television signals. The VHF television signals are supplied from VHF input terminal 2 to a television receiver circuit 101 which detects the video and audio signals included in the VHF television signals supplied thereto. Television receiver circuit 101 conventionally includes a signal distributor 3, a tuner 5, an IF amplifier 6, a video detector 7, an amplifier 8, and a sound detector 9.

The video signal from video detector 7 and the audio signal from sound detector 9 are supplied to a video and audio recording circuit 102. Video and audio recording circuit 102 includes a video recording circuit 10 and a sound recording circuit 11. Video recording circuit 10 supplies a video signal through a switch SW_1 to rotary video heads H_1 and H_2 for recording thereby in skewed parallel tracks on a magnetic tape T when video cassette recorder 100 is operated in a recording mode. Sound recording circuit 11 supplies an audio signal through a switch SW_2 to a fixed audio head H_3 for recording by the latter in a longitudinal track on magnetic tape T when video cassette recorder 100 is operated in the recording mode.

In the illustrated system, switches SW_1 and SW_2 are included in a switching circuit 103 connected

between video and audio circuit 102 and video and audio heads H_1 , H_2 , and H_3 , respectively. Switches SW_1 and SW_2 switch video and audio signals to and from video and audio heads H_1 , H_2 , and H_3 , according to the operation of video cassette recorder 100 in the recording or in the reproducing mode.

A video and audio reproducing circuit 104 is also connected through switching circuit 103 to video and audio heads H_1 , H_2 , H_3 . Video and audio reproducing circuit 104 includes a video reproducing circuit 12 which receives the video signal from the video heads H_1 , H_2 through switch SW_1 and generates a composite video signal in response thereto. An audio reproducing circuit 13 is also included in video and audio reproducing circuit 104 and receives a reproduced audio signal from audio head H_3 through switch SW_2 for generating an audio signal in response thereto.

The composite video signal from video reproducing circuit 12 and the audio signal from audio reproducing circuit 13 are supplied to a video and audio switching circuit 105. Video and audio switching circuit 105 includes a video switch SW_3 which receives the composite video signal from video reproducing circuit 12 and an amplified video signal from amplifier 8. An audio switch SW_4 included in video and audio switching circuit 105, receives, as its input signals, the audio signal from audio reproducing circuit 13 and the audio signal from detector 9. Video and audio switching circuit 105 supplies the selected video and audio signals to video and audio signal output

terminals 14, 15, respectively. In the illustrative embodiment, the amplified video signal from amplifier 8 and the audio signal from sound detector 9 are supplied to video and audio output terminals 14, 15 when video cassette recorder 100 is operated in any mode other than the reproducing or playback mode, i.e., when in a recording mode and in a stop mode. In such recording and stop modes, video and audio signals from television receiver circuit 101 are supplied to video and audio signal output terminals 14, 15.

10 Video cassette recorder 100 includes a tape loading motor 16 for withdrawing magnetic tape T from a video cassette (not shown), a drum motor 17 for rotating a drum which includes video and audio heads H_1 , H_2 and a capstan motor 18 for driving magnetic tape T at a constant
15 speed. Video cassette recorder 100 also includes an electro-mechanical section 19 which receives control signals from a system controller 20 and which operates the various mechanical portions of video cassette recorder 100 in the desired operating modes.

20 System controller 20 may be a CPU or microprocessor which supervises the various functions and operating modes of video cassette recorder 100. In a preferred embodiment, system controller 20 includes a microcomputer which is responsive to a channel selector 21,
25 a function selector 22, and a timer 23, and which is responsible for operating the entire video cassette recorder 100 in the desired modes.

Channel selector 21 is connected to system controller 20, as aforesaid, and is used to select the

various channels to be tuned and recorded by video cassette recorder 100. In a television channel selector 21 according to the prior art, push buttons 300 are provided for choosing channels 2 through 13 and LED's 301 are associated with the 5 push-buttons 300 to be illuminated for indicating the respective channel has been selected. It is to be appreciated that channel selector 21 operates through system controller 20 to control the channel signal tuned by tuner 5.

10 Function selector 22 supplies control signals to video cassette recorder 100 through system controller 20 and can be conventionally constructed for selecting various functions or operating modes, such as, for example, playback, record, stop, fast forward, rewind and picture 15 search.

 The composite video signal from video signal output terminal 14 and the audio signal from audio signal output terminal 15 are supplied to a descrambler 106. The audio signal from audio signal input terminal 24 is supplied 20 to an audio descrambler 30, an RF modulator 32, and thence, to a switch SW₇. When the audio signal from audio signal input terminal 24 is not scrambled, it is supplied directly to a switch SW₅ and thence, to an audio signal output terminal 27. A scrambled video signal from video signal 25 input terminal 25 is supplied to a video descrambler 31 and then, to RF modulator 32. The descrambled video signal is also supplied from video descrambler 31 to a switch SW₆ and thence, to a video signal output terminal 28. An unscrambled television signal is also supplied from video

signal input terminal 25 to switch SW₆. A VHF output
signal from signal distributor 3 is supplied to a VHF
antenna terminal 4. The output signal from VHF antenna
terminal 4 is supplied to a VHF input terminal 26. The
5 signal from VHF input terminal 26 is supplied to switch
SW₇. Switch SW₇ alternately supplies the output signal
from RF modulator 32 and the VHF signal from VHF input
terminal 26 to a VHF output terminal 29. In the illustrated
system, switches SW₅ and SW₆ are ganged and supply video
10 and audio signals from video and audio signal input
terminals 24, 25 directly to video and audio signal output
terminals 27 and 28 when the input signals are conventional
television signals. When the input signals are scrambled
television signals, switches SW₅ and SW₆ supply the
15 descrambled signals to video and audio signal output
terminals 27, 28.

Switch SW₇, which can be manually operated,
supplies VHF signals from VHF input terminal 26 to VHF
output terminal 29 when the input VHF signals are
20 conventional television signals. When scrambled television
signals are selected, switch SW₇ selects the RF modulated
video and audio signals from RF modulator 32 to be supplied
to VHF output terminal 29.

A television monitor 107 is coupled to descrambler
-25 106 and permits a viewer to view the unscrambled television
signals supplied thereto. A conventional television
receiver does not have audio and video input terminals.
Therefore, VHF output terminal 29 of descrambler 106 is
connected to an input antenna terminal 33 of a conventional

television receiver when the latter is used as television monitor 107. If television monitor 107 has audio and video input terminals 34, 35, respectively, audio and video signal output terminals 27, 28 of descrambler 106 can be directly connected thereto, as indicated by the dotted lines in Fig.

1.

The prior art timer of Fig. 3 is connected to system controller 20 and can be preset so that video cassette recorder 100 of Fig. 1 will record a desired television program which is transmitted on a predetermined channel, at a predetermined date, and time. The timer of Fig. 3 includes a keyboard 231 which can be used to preset the channel, date and time for the television program to be recorded. A channel memory 232, which may be a random access memory (RAM), is connected to keyboard 231 and stores the channel numbers for selected television programs. A date memory 233, which may be another RAM, is connected to keyboard 231 and stores date information which corresponds to the channel information stored in memory 232 for the selected programs. A time memory 234, which may also be another RAM, is connected to keyboard 231 and stores time information corresponding to the channel and date information or in memories 232 and 233 for the selected television programs.

In the illustrated prior art timer, time memory 234 can store both the start time and the end time of each period during which video cassette recorder 100 is to be operated, or memory 234 may store only the start time of each recording operation of video cassette recorder 100. It

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is to be appreciated that prior art video tape recorders automatically shut-off when the end of the tape is sensed.

The timer of Fig. 3 further includes a clock 235 which provides time and date information, and a display 236
5 which indicates the current time and date information from clock 235. Display 236 can also indicate the channel, date and time information entered from keyboard 231 and stored in channel memory 232, date memory 233 and time memory 234. A first coincidence detector 237 is coupled to date memory 233
10 and clock 235 for providing a digital "1" signal when the date data stored in date memory 233 coincide with the current date data from clock 235. A second coincidence detector 238 is connected to time memory 234 and clock 235, and generates a digital "1" signal when the time data in
15 time memory 234 coincide with the current time data from clock 235. An AND gate 239 receives the output signals from first and second coincidence detectors 237, 238 and supplies a digital "1" signal when the signals supplied thereto coincide, i.e., AND gate 239 supplies a "1" as its output
20 signal when the stored date and time data coincide with the current date and time data, respectively. A gate circuit 240 is connected to channel memory 232 and the output terminal of AND gate 239. Gate circuit 240 supplies channel data from channel memory 232 when the output signal of AND
25 gate 239 is "1", that is, when both the date and time data stored in the respective memories 233, 234 coincide with the current date and time.

A push-button actuated switch 241 is actuated whenever it is desired to operate video cassette recorder

100 in accordance with the data stored in channel memory
232, date memory 233 and time memory 234. An LED indicator
242 is associated with push-button actuated switch 241 and
indicates when video cassette recorder 100 is set to operate
5 in accordance with the stored data. An AND gate 243 is
connected to receive the output signals from gate circuit
240 and switch 241 and can supply an output signal to system
controller 20 only when switch 241 has been actuated. An
AND gate 244 is connected to receive the output signals from
10 AND gate 239 and timer set switch 241, and AND gate 244 can
supply an output signal to system controller 20 only when
switch 241 has been actuated.

System controller 20 receives selected channel
data from AND gate 243 and time data from AND gate 244 when
15 channel, date and time data are entered by keyboard 231 into
memories 232, 233, 234 and switch 241 is actuated. System
controller 20 generates control signals to place video
cassette recorder 100 in a recording mode at the selected
time.

20 The timer circuit according to the embodiment of
this invention shown on Fig. 4 shares many of the component
parts or elements of the prior art timer circuit of Fig. 3,
and such parts or elements are identified by the same
reference numerals and will not be further described for the
25 sake of brevity. The timer circuit of Fig. 4 is shown to
further include a read only memory (ROM) 232' which stores a
channel control signal corresponding to the channel on which
a scrambled television signal will be broadcast for
recording. For example, the scrambled television signal

may be transmitted on channel 7, so that ROM 232' stores a channel control signal corresponding to channel 7. A second read only memory (ROM) 234' stores time information corresponding to the time when the scrambled television
5 signal will be broadcast. For example, if the scrambled television signal is broadcast from 2:30 A.M. to 5:30 A.M., ROM 234' stores corresponding time control signals.

A coincidence detector 238' receives time data from ROM 234' and current time data from clock 235.
10 Coincidence detector 238' generates an output signal of "1" when the time data stored in ROM 234' coincides with current time data supplied from clock 235. A gate circuit 240' is gated by the output signal "1" from coincidence detector 238' for passing the channel control signal from ROM 232' to
15 an AND circuit or gate 243'. Gate circuit 240' permits the channel control signal to be supplied from ROM 232' to system controller 20 only when the predetermined time from ROM 234' coincides with the current time.

A selector 250, which is shown as a switch in the
20 illustrated embodiment, is actuatable to select the predetermined channel over which the scrambled television signal is transmitted. In the preferred embodiment, selector 250 is associated with a respective push button 300a (see Fig. 5) which may be proximate to the array of
25 push buttons 300 of a conventional channel selector. Button 300a, however, is labeled to indicate that it is actuatable for achieving recording of the scrambled television signal. In the illustrated embodiment, button 300a is labeled HVN, corresponding to, for example, the Home Video Network. An

LED indicator 251 is associated with selector 250 and is illuminated when selector 250 is actuated for achieving recording of the Home Video Network signal. The LED indicator 251 associated with selector 250 may be similarly
5 positioned in the array of LED's 30 associated with the conventional channel selecting push-button, as at 301a on Fig. 5.

AND gate 243', receives, at one input terminal, a signal from selector 250 and, at its other input terminal,
10 the output signal from gate circuit 240'. An AND gate 244' also receives, at one input terminal, the signal from selector 250 and, at its other input terminal, the output signal from coincidence detector 238'. AND gates 243' and 244' supply respective control signals to system controller
15 when the Home Video Network signal has been selected, and when the current time coincides with the predetermined time at which that signal is broadcast.

In the embodiment of Fig. 4, the channel and time data corresponding to the Home Video Network signal are
20 stored in ROM's 232', 234' at the factory since they are read only memories and cannot be changed. Accordingly, a user need only actuate the Home Video Network button 300a in order to insure that the scrambled television signal will be recorded at such future time when it is broadcast. In the
25 preferred embodiment, selector switch 250 (associated with Home Video Network button 300a) is positioned proximate channel selector 21 and/or function selector 22 (see Fig. 1) so that a user is not particularly aware that an operation of timer 23 is called for when selector 250 is actuated to

provide for recording of the Home Video Network signal. It is to be appreciated that a user thus regards the Home Video Network button 300a merely as a channel or function selector and is not concerned with the time when the Home Video
5 Network program is broadcast. It will be appreciated that, if desired, selector switch 250 may be mechanically or otherwise ganged with switch 241 to open the latter when switch 250 is closed, whereby to prevent interference of any other preset channel selection with the desired recording of
10 the scrambled television signal program.

It is to be noted that, in the embodiment of Fig. 5, the Home Video Network button 300a is provided as one of the push button elements in a channel selector. In such case, the Home Video Network button 300a is itself
15 indistinguishable from the other channel selection buttons, and, thus, may be as easily and casually actuated as any of such other channel selection buttons. Of course, as earlier noted, the Home Video Network button 300a is identified by a suitable legend and, when that button is
20 actuated, a user can easily recognize, by illumination of the respective LED at the position 301a, that video cassette recorder 100 has been preset to record the scrambled television signal when the latter is broadcast.

In the embodiment of the invention shown on Fig. 6, and which is otherwise similar to that of Fig. 4, programmable read only memories (PROM's) 232₁' and 234₁' which replace ROMs 232' and 234' are rewritable or changeable non-volatile units. Accordingly, keyboard 231 is

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selectively coupled to PROM's 232₁' and 234₁' or to the channel and time memories 232 and 234 through respective switches SW₁₀ and SW₁₁ used for entering time and channel data. MNOS memory units are suitable for use as the 5 rewritable or changeable non-volatile PROM's 232₁' and 234₁'.

In the embodiment of the invention shown on Fig. 7, and which is otherwise similar to the embodiment of Fig. 4, ROM 232', which stores the channel control signals 10 corresponding to the Home Video Network channel, is eliminated by ganging selector switch 250 with a switch 250'. In the illustrated embodiment, the Home Video Network channel (HVN) corresponds, for example, to channel 7. While selector switch 250 is shown located a distance from switch 15 250' in Fig. 7, they are mechanically or otherwise ganged so that actuation of selector switch 250 also actuates switch 250'. Thus, it will be appreciated that the channel information is mechanically "memorized" by the actuation of switch 250' upon or in response to the actuation of selector 20 switch 250.

In the embodiments described above, only one scrambled television signal is transmitted at a time. Accordingly, only one set of time data is stored in ROM 234'. However, it is to be appreciated that a plurality of 25 scrambled television signal programs can be transmitted at different times. For example, Fig. 8 schematically illustrates an embodiment of the present invention in which two scrambled television signal programs indicated by HVN₁ and HVN₂ are transmitted at two different times.

30 Accordingly, two sets of time data are stored in respective

ROM's 234₂' and 234₂' and such time data are selectively applied to coincidence detector 238' on Fig. 4 in response to the selective actuation of push buttons 300a₁, and 300a₂ for selecting the programs HVN₁ and HVN₂, respectively. It is to be further appreciated that additional ROM's and selector buttons can be added according to the number of scrambled television programs which are broadcast.

In the embodiments described above, it has been assumed that only one VHF channel transmits the scrambled television signal. However, a plurality of VHF channels can, of course, broadcast a plurality of scrambled television signal programs. Accordingly, as illustrated schematically on Fig. 9, a plurality of ROM's can be provided for channel and time data corresponding to a plurality of scrambled television signal programs. More particularly, in the embodiment of Fig. 9, in which two scrambled television signal program are broadcast on two respective VHF channels, ROM 234a supplies the time data for the first scrambled television signal program identified as HVN₁ and ROM 232a supplies the channel data corresponding to HVN₁. Further, in Fig. 9, ROM 234b supplies time data for the second scrambled television signal identified as HVN₂ and ROM 232b supplies the channel data for HVN₂.

In the embodiment of Fig. 10, the channel memories 232a, 232b of Fig. 9 have been eliminated, and the channel information for the programs HVN₁ and HVN₂ is mechanically "memorized" in response to actuation of selector buttons 300a and 300b which are labeled HVN₁ and

HVN₂. As shown by way of example, the push buttons 300a and 300b may be operable to mechanically close normally open switches which are in parallel with the channel selecting switches for selecting channels 7 and 10, respectively. In
5 that case, it is assumed that the programs HVN₁ and HVN₂ of scrambled television signals are broadcast on channels 7 and 10, respectively.

It is to be appreciated that the present invention is applicable not only to pre-engaging a particular channel
10 over which a scrambled television signal is broadcast late at night, as in a pay or subscriber television system, but may also be applied to any other system in which it is desired to pre-select a channel and time for a particular series of programs.

15 Although specific embodiments of the present invention have been described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and
20 modifications may be effected therein by one skilled in art without departing from the spirit and scope of the invention as defined in the appended claims.

CLAIMS

1. A video recording apparatus for automatically recording information being broadcast on at least one predetermined channel at a predetermined time including a tuner for tuning to any one of a plurality of channels
5 received thereby and including a channel selecting device actuatable for selecting said one predetermined channel, a recorder for recording information broadcast on the channel to which said tuner is tuned, a timer actuatable for causing operation of said recorder at said predetermined time;
10 characterized by a single manually operable actuating member (300a; 300a₁, 300a₂; 250'; 300a, 300b) for simultaneously actuating said channel selecting device and said timer (235, 237, 238, 238') so that said recorder (100) records said information broadcast on said one predetermined channel at
15 said predetermined time.

2. The video recording apparatus of claim 1; further characterized by a time memory unit (234'; 234₁'; 234₂', 234₂'; 234a, 234b) for storing time control signals corresponding to said predetermined time.

20 3. The video recording apparatus of claim 2; further characterized by a channel memory unit (232'; 232₁'; 232a, 232b) for storing channel control signals corresponding to said one predetermined channel.

4. The video recording apparatus of claim 1, wherein said channel selecting device includes a plurality of regular channel control elements, each corresponding to one of said plurality of channels on which regular programs are broadcast; further characterized in that said actuating member (300a; 300a₁, 300a₂; 250'; 300a, 300b) includes an additional channel control element (300a; 300a₁, 300a₂; 300a, 300b) similar to said channel control elements and being operable for selecting said one predetermined channel.
5. The video recording apparatus of claim 4; characterized in that actuation of said additional channel control element (300a; 300a₁, 300a₂; 300a, 300b) deactivates said regular channel control elements whereby said tuner (5) tunes only said one predetermined channel.
6. The video recording apparatus of claim 4; characterized in that said additional channel control element (300a; 300a₁, 300a₂; 300a, 300b) and said regular channel control elements include respective manually actuatable pushbuttons.
7. The video recording apparatus of claim 1; further characterized by a second manually operable actuating member (300a₁ or 300a₂; 300a or 300b) for simultaneously actuating said channel selecting device and said timer (235, 237, 238, 238') so that said recorder (100) records said information broadcast on said at least one predetermined channel at a second predetermined time differing from the first-mentioned predetermined time.
8. The video recording apparatus of claim 7; further characterized by a time memory (234₂', 234₂"; 234a,

234b) for storing first and second time control signals corresponding to said first and second predetermined times, respectively.

9. The video recording apparatus of claim 8;
5 further characterized by a channel memory (232a, 232b) connected to said channel selecting device for storing first and second channel control signals corresponding to first and second predetermined channels.

10. The video recording apparatus of claim 9,
10 wherein first and second scrambled television signal programs followed by first and second descrambling code signals are broadcast at said first and second predetermined times on said first and second predetermined channels;
further characterized in that said first and second manually
15 operable actuating members (330a₁, 300a₂; 300a, 300b) are actuated to record said first and second scrambled television program signals, respectively, with said recorder (100).

FIG. 1
PRIOR ART

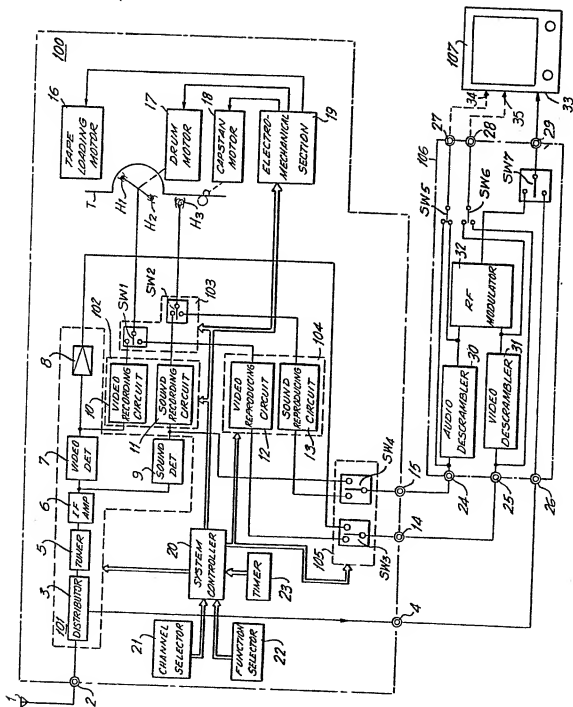


FIG. 2
PRIOR ART

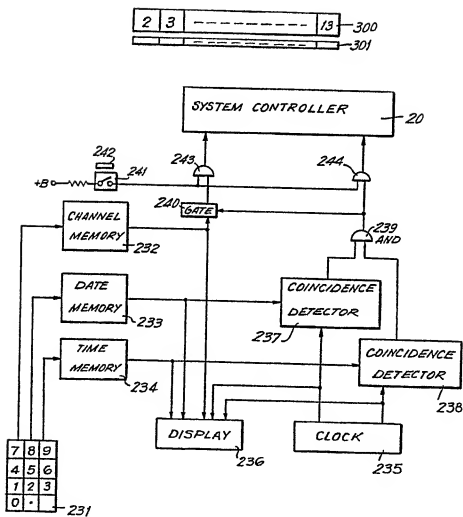


FIG. 3
PRIOR ART

FIG. 4

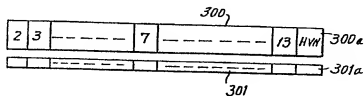
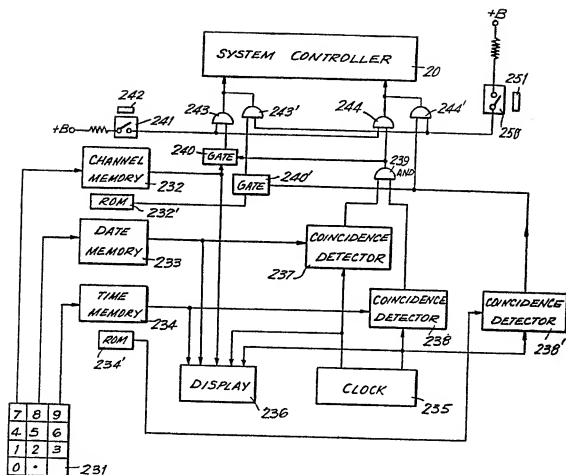


FIG. 5

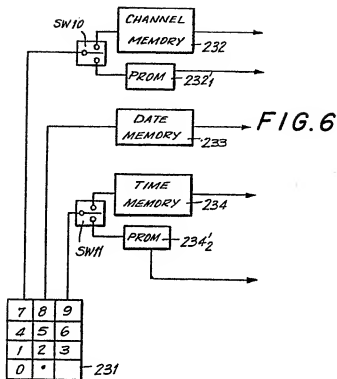
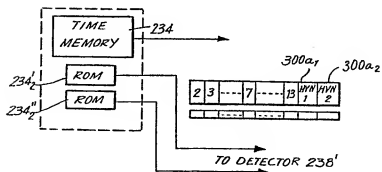
**FIG. 8**

FIG. 9

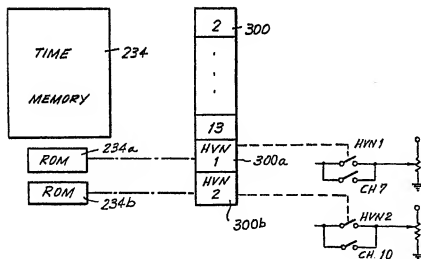
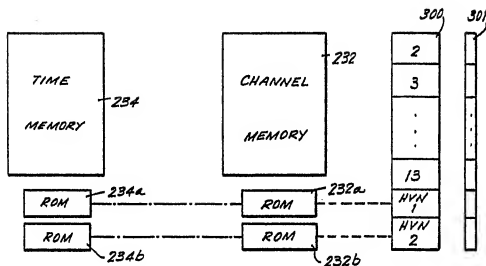


FIG. 10